INFORMATION FOR YOUR SAFETY

FYS

US Regulatory Standards for Hand Protection

OSHA® Occupational Safety and Health Administration

OSHA 29 CFR 1910.138

(a) General requirements. Employers shall select and require employees to use appropriate hand protection when employees' hands are exposed to hazards such as those from skin absorption of harmful substances, severe cuts or lacerations, severe abrasions, punctures, chemical burns, thermal burns and harmful temperature extremes.

(b) Selection. Employers shall base the selection of the appropriate hand protection on an evaluation of the performance characteristics of the hand protection relative to the task(s) to be performed, conditions present, duration of use and the hazards and potential hazards identified.

ANSI/ISEA 105-2016

ANSI/ISEA 105-2016 addresses the classification and testing of hand protection for specific performance properties related to chemical and industrial applications. This standard provides performance ranges related to mechanical protection (cut-resistance, puncture resistance and abrasion resistance), chemical protection (permeation resistance, degradation) and other performance characteristics such as ignition resistance and vibration reductions based on standardized test methods.

Cuff Styles

Knitwrist

Prevents dirt and debris from getting inside the glove. Keeps cold air out and warmth in by fitting under clothing sleeves.

Safety Cuff

Easy to remove in emergency situations and gives added protection to the forearm. Length varies from 2½" to 2¾".

Gauntlet Cuff

The longer cuff offers greater protection to the upper wrist. Typically 4½" or longer and has the same features as the safety cuff.

Band Top

Light wrist protection. Allows air to circulate around hand.

Slip-On

Has no cuff. Easy on-off. Used primarily in general purpose applications and on drivers gloves.

Rolled Beaded Cuff

For increased protection from chemical droplets and increased cuff strength.

Pinked or Serrated Cuff

Provides better gripping surface on edge for easier glove removal.

Straight Cuff

Provides additional length in order to protect from chemical runoff.

Knitwrist

Safety Cuff

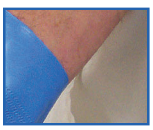
Gauntlet Cuff

Band Top

Slip-On

Rolled Beaded

Pinked or Serrated



Straight

How to Choose the Proper Glove Size

Wearing properly sized gloves is as important as the glove you choose. First, measure the circumference of your hand as illustrated here, then compare it to the sizing chart.

Sizing Chart

Glove	XSmall	Small	Medium	Large	XLarge
Hand	6"–7"	7"–8"	8"–9"	9"–10"	10"–11"

Glove Care and Maintenance

Proper care and cleaning of gloves on a regular basis is essential in maintaining quality hand protection for employees.

Cleaning and Washing: Most styles of gloves will perform better and last longer when they are cleaned regularly. Certain glove styles launder better than others. Consult a Sales Representative for assistance with your glove selection.

Inspection: Daily inspections are recommended prior to wearing, to assure that no significant damage to either the inside or outside surface of the glove has occurred.

Storage: Gloves should be stored in well-ventilated bins or shelves at normal room temperature free from direct sunlight.

General Purpose Glove Information

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General Purpose Gloves

General purpose gloves provide protection for a wide variety of applications and tasks from dirt and mechanical hazards, such as sharp or abrasive objects. Protection can vary depending upon the materials and construction of the glove. Different coatings can also improve grip and reduce hand fatigue.

Glove Materials

Cotton: A natural fiber used for basic abrasion protection and mild heat protection in heavier weights.

Polyester: A synthetic fiber used for basic abrasion protection. Mainly used in seamless gloves or as a blend to strengthen cotton knit materials.

Nylon: A synthetic, low lint, high tensile strength fiber that offers excellent dexterity and tactile sensitivity.

Acrylic: A synthetic fiber that helps provide insulation from cold temperatures and dries quickly.

Glove Construction

Cut and Sewn Gloves: Fabrics like canvas, jersey, or leather are cut into components using a pattern and sewn together to make a glove. Gloves produced this way provide basic protection.

Seamless String Knit Gloves: Knit gloves offer seamless construction and are produced on knitting machines in various gauges. Gauge refers to the number of rows of stitches per inch. A higher gauge produces a finer, tight weave, whereas a lower gauge produces a bulkier, loose weave glove. String knits are typically 7, 10 or 13 gauge and are produced in a variety of weights from lightweight to heavyweight. Finer gauge liners are typically used for inspection/lisle gloves and as a base fabric for many coated glove applications which demand extreme dexterity and tactile sensitivity.

Glove Coatings

General purpose coated gloves are produced by dipping cut and sewn or seamless knit liners into various polymers. The coatings help to enhance mechanical properties and grip characteristics to improve the wear life of the glove while maintaining dexterity, tactile sensitivity and overall comfort. Coated gloves provide an excellent alternative to leather as they provide a superior fit that is both comfortable and functional.

Coated gloves have different amounts of coating coverage. Palm-coated gloves allow for ventilation on the back of hands, but with a lower level of full hand protection. Three-quarter or fully-coated gloves provide added protection to the back of the hand.

Latex: An economical coating widely used for its superior flexibility and resistance to tear. Latex coatings offer good mechanical protection and enhanced grip and, compared to other materials, withstand extreme temperatures. However, latex performs poorly, and may swell and degrade, when coming into contact with oils and hydrocarbons.

Polyurethane (PU): A synthetic material that is highly flexible and soft with excellent tensile strength. Because of its toughness, PU coatings can often be thinner than other polymers to maximize tactile sensitivity while maintaining comparable levels of protection. PU provides good abrasion and tear resistance with exceptional wet/dry grip and resistance to oil. Polyurethane has a low particulate shed making it a good choice for high tech applications.

Polyvinyl Chloride (PVC): A synthetic thermoplastic polymer with a broad range of low hazard chemical resistance that is exceptionally durable. PVC offers good abrasion resistance, though it may be susceptible to punctures, cuts and snags. PVC can also be applied as an air-infused coating offering exceptional wet and dry grip with good mechanical properties. It stays flexible at lower temperatures making it a coating of choice in cold environments.

Nitrile: A widely used synthetic rubber with a high abrasion, cut and chemical resistance that stands up well to oil. It performs well at higher temperatures and offers a good alternative to users with latex allergies. Foamed nitrile or sponge nitrile coatings are also used to create an open surface texture to channel light oils from glove surfaces for enhanced grip on wet and oily surfaces.

Mechanical Hazard Regulatory Standards

U.S. — ANSI/ISEA 105-2016:

The Hand Protection Group of the International Safety Equipment Association (ISEA) has standards to assist employers and users in the appropriate selection of gloves for specific workplace exposures. The chart below provides performance ratings that interpret test results for mechanical hazards such as abrasion resistance and puncture resistance.

Rating	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
Abrasion Resistance (Cycles)	<100	≥100	≥500	≥1,000	≥3,000	≥10,000	≥200,000
Puncture Resistance (Newtons)	<10	≥10	≥20	≥60	≥100	≥150	–

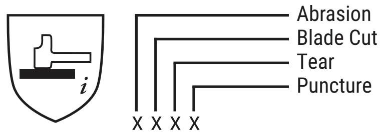
Abrasion ratings 0 through 3 are based on measurements with 500-gram load. 4 through 6 are measurements with a 1,000-gram load.

European — EN388:

Many U.S. glove users are becoming aware of markings and symbols on their gloves that relate to European Regulatory Standards. Though not required in the U.S., they offer some useful information. One such marking for general purpose gloves certifies independent testing against the requirements of EN388 for mechanical hazards (abrasion, cut, tear and puncture resistance). The series of numbers adjacent to the EN388 pictograph represent the performance level of each hazard.

Number	Rating	Level 0	Level 1	Level 2	Level 3	Level 4	Level 5
1	Abrasion Resistance (Cycles)	<100	≥100	≥500	≥2,000	≥8,000	–
2	Cut Resistance (Index)	<1.2	≥1.2	≥2.5	≥5.0	≥10.0	≥20.0
3	Tear Resistance (Newtons)	<10	≥10	≥25	≥50	≥75	–
4	Puncture Resistance (Newtons)	<20	≥20	≥60	≥100	≥150	–

CE Standards Mechanical Hazard EN388



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Chemical-Resistant Glove Information

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Glove Selection for Chemical/Liquid Resistance Applications

Where chemical hazards or immersion in liquids is a concern, chemical/liquid resistant gloves are available in various compounds, and in supported or unsupported styles to protect the hands. Several things to consider when selecting the gloves needed for each particular application include:

Supported vs. Unsupported

Base fabrics for supported gloves include jersey, which is soft and helps to absorb perspiration, or a thinner interlock fabric that helps give the glove added strength for resistance to cuts, snags, abrasions and punctures.

Unsupported gloves provide enhanced dexterity and are either lined or unlined. Unsupported lined gloves have a thin coating (commonly referred to as a flock lining) embedded on the interior of the glove to help absorb perspiration, add comfort and aid in donning and doffing.

Permeation and Degradation

Permeation and degradation are two ways of measuring the protective capabilities of a material. It's important to choose the right glove to protect against the specific chemicals present in each application.

- Permeation is the process in which a chemical can pass through protective film without going through pinholes, pores or other visible openings. The chemical molecules move between the molecules of the material and make their way to the other side of the film. Breakthrough is calculated in minutes and represents the time it takes for the chemical to first be detected on the other side of the film. Rate is a measurement of the highest flow rate for the permeating chemical during the course of a six hour test.
- Degradation is the reduction of one or more physical properties of a glove due to contact with a chemical. Certain glove materials may become hard, stiff or brittle, or they may become softer, weaker and swell to several times their original size. If significant degradation occurs, a glove's permeation resistance is quickly impaired, but degradation and permeation do not always correlate.

Chemical resistance testing that conforms to Industry Standards includes:

- ASTM F739 Standard Test Method for Permeation of Liquids and Gases through Protective Clothing Materials Under Conditions of Continuous Contact
- ASTM F1383 Standard Test Method for Permeation of Liquids and Gases through Protective Clothing Materials Under Conditions of Intermittent Contact
- EN 374 European Standard Protective Gloves Against Chemicals and Micro-Organisms

Material Selection Guide For Chemical Resistance

Natural Rubber Latex (NRL) gloves resist bases, acids, alcohols and diluted aqueous solutions of most types of chemicals. They also offer fair protection against undiluted ketones and aldehydes. In addition, natural rubber latex provides some resistance to cuts. There have been some reports of allergic reactions to the proteins in natural rubber. In cases of latex sensitivity, nitrile, neoprene and PVC are good alternatives.

The synthetic rubber compound, **Nitrile**, offers good protection against bases, oils, many solvents and esters, grease and animal fats. Nitrile gloves are not recommended for ketones and some organic solvents. They do provide, however, excellent resistance to snags, punctures, abrasions and cuts.

Neoprene (polychloroprene) is another synthetic rubber compound. Neoprene gloves protect against a very broad range of oils, acids, caustics and solvents. Neoprene offers less resistance to snags, punctures, abrasions and cuts than nitrile or natural rubber.

Polyvinyl Alcohol (PVA) is highly resistant to aliphatics, aromatics, chlorinated solvents, esters and most ketones. PVA gloves also resist snags, punctures, abrasions and cuts, but quickly break down when exposed to water and light alcohols.

Polyvinyl Chloride (PVC) gloves provide protection against many acids, caustics, bases and alcohols. PVC is not recommended for ketones or many other types of solvents. It generally offers good abrasion and cut resistance, but some glove styles are susceptible to cuts.

Polyethylene offers economical protection from mild chemicals, oils, fats, punctures and abrasions. Component materials of polyethylene gloves comply with FDA regulations for food contact.

Polyurethane (PUR) gloves resist bases, acids, alcohols, grease and animal fats. They're not recommended for most types of organic solvents. Polyurethane provides excellent snag, puncture, abrasion and cut resistance. In the form of a foam, it can be highly effective as an insulating liner inside some types of supported gloves.

Butyl rubber gloves offer superior resistance to highly corrosive acids, ketones and esters. They protect well against bases, alcohols, amines and amides, glycol ethers, nitro-compounds and aldehydes. Butyl is not recommended for halogen compounds, aliphatic or aromatic hydrocarbons, or applications that require the physical strength of natural rubber. This synthetic rubber provides the highest permeation resistance to gases and water vapors of any protective material used to make gloves.

DuPont™ Viton® is the most chemical resistant of all the rubbers and protects against toxic and highly corrosive chemicals. Viton® gloves protect against polychlorinated biphenyls (PCB's), polychlorinated triphenyls, benzene and aniline. A flouroelastomer, Viton® provides excellent resistance to aromatic and aliphatic hydrocarbons as well as chlorinated solvents. It is not recommended for ketones.

Heavyweight Viton® is required for protection from physical hazards. It is primarily used when the life span of other gloves is too short to be economical.

Chemical resistance is fairly complex. Please refer to the following glove manufacturers' chemical resistance websites for more specific information.

https://www.ansellguardianpartner.com/
https://chemrest.com/

Cut-Resistant Glove Information

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Cut Resistance Defined

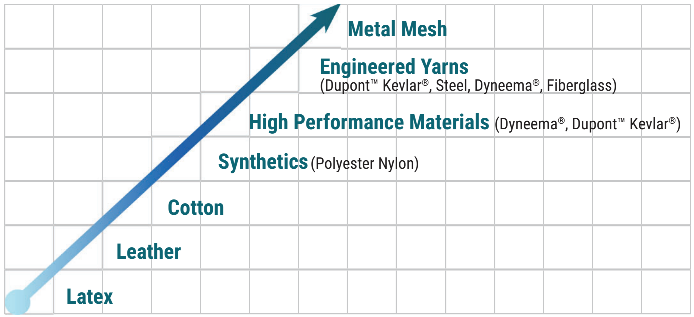
Cut-resistant gloves provide protection against sharp objects such as glass and sharp metals. Gloves that provide cut resistance and cut protection do not completely prevent or eliminate the potential for cuts and punctures, and are not intended or tested to provide protection from powered blades, serrated or other sharp or rotating objects.

Cut resistance is a function of a glove material composition and weight (ounces per square yard). Cut protection can be influenced by the factors noted below. The more of these factors that can be engineered into a yarn, the more cut-resistant it will be.

- **Strength:** Examples include high performance yarns such as DuPont™ Kevlar®, Dyneema®, Spectra®, etc.
- **Hardness (dulling):** An example of hard yarn would be stainless steel, which is often a primary component in engineered yarns
- **Lubricity (slickness):** Yarns such as Dyneema® and Spectra® allow a blade to slide over the surface without cutting through
- **Roll:** Most knit gloves allow the individual yarns to roll as a sharp edge slides over them

Remember – There is no such thing as a cut-proof glove

Cut Resistance Material Strength



Cut Resistance and Testing

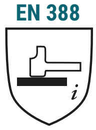
Globally, there are two different performance standards for cut resistance: the European Standard EN388 and the ANSI/ISEA 105 Standard for the U.S. Cut level results of EN388 and ANSI/ISEA standards cannot be correlated. The testing methods are not identical, so when referring to a cut level, know which standard is being referenced in order to set the right expectations for performance and specifications.

EN388-2016

The European Standard for Protective Gloves, EN388, is the European standard used to evaluate mechanical risks for hand protection and was updated on November 4, 2016. Gloves with an EN388 rating are third party tested, and rated for abrasion, cut, tear, and puncture resistance. Cut resistance is rated 1–5, while all other physical performance factors are rated 1–4. The new EN388-2016 standard uses both the "Coup Test" and the "TDM-100 Test" to measure cut resistance for a more accurate score. Also included in the updated standard is a new Impact Protection test.

New Marking

EN 388



4 4 4 2 C X

	Rating
Abrasion	1–4
Cut (Coup Test)	1–5
Tear	1–4
Puncture	1–4
Cut (TDM-100 Test)	A–F
Impact Protection	P, F, X

Table 1: Comparison of EN388-2016 and ANSI/ISEA 105-2016

To differentiate between the two cut scores that will be generated under the new EN388-2016 standard, the cut score achieved using the ISO 13997 test method (TDM-100) will have a letter added to the end of the first four digits. The letter assigned will depend on the result of the test, which will be given in Newtons. The comparison table below outlines the new alphabetic scale used to calculate the results from the ISO 13997 test method.

EN 388 Rating	Range (Newtons)	Converted Range (Grams)	ANSI/ISEA 105 Level	Range (Grams)
A	2–4.9	204–508	A1	200–499
B	5–9.9	509–1,019	A2	500–999
C	10–14.9	1,020–1,529	A3	1,000–1,499
D	15–21.9	1,530–2,242	A4	1,500–2,199
E	22–20.9	2,243–3,058	A5	2,200–2,999

ANSI/ISEA 105-2016 Ratings

The American National Standards Institute / International Safety Equipment Association (ANSI/ISEA) 105-2016 American National Standard for Hand Protection Classification is the latest revision of a standard first published in 1999, and revised in 2005 and 2011. This standard addresses the classification and testing of hand protection for specific performance properties related to chemical and industrial applications. It provides, or refers to, appropriate test methods and provides pass/fail criteria used by manufacturers to classify their products. End users can use this information to review the documentation received from their supplier to help verify the gloves they are considering meet their needs. When tested using the Cut Performance Protection Test (CPPT), the glove's cut resistance is classified as A1-A9, as shown in the comparison Table 1.

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Disposable Gloves

Before purchasing any glove, whether it is manufactured using latex, vinyl or nitrile, companies must assess a few factors:

- The amount of protection employees will need
- Allergies...possible allergic reactions to any glove materials
- Chemical Resistance...resistance varies with chemical concentration, glove thickness, temperature and length of exposure to chemicals
- Barrier Properties...testing performed to indicate critical parameters such as AQL, elongation, tensile strength and modulus properties
- Comfort and Fit...sizing, dexterity and grip

Disposable Glove Properties

AQL (Acceptable Quality Level): The AQL is used to determine the pass/fail criteria for a select sample size. The lower the AQL number, the fewer the defects allowed to pass. The FDA specifies an AQL of 1.5 for surgical gloves, 2.5 for examination gloves and 4.0 or better for industrial grade gloves.

Chlorination: A process by which gloves are exposed to a chlorine solution followed by multiple washing and leeching processes. The chlorination process hardens the surface of a glove reducing tackiness and decreases the surface friction of the glove thereby allowing it to be easily donned. The chlorination process provides an added benefit by greatly reducing the level of soluble latex protein.

Elongation: The percentage a glove can be stretched from its original length before it fails. For example, a score of 600% indicates the glove stretched six times its initial length before breaking. Higher percentages indicate a highly elastic glove which can be an indication of improved comfort.

Mil: A unit of measure, one thousandth of an inch (0.001 inch) or approximately 0.0254 millimeter, used in reporting glove thickness. Most glove thicknesses are measured at the fingertip, palm and cuff.

Powdered: A USP grade absorbable powder coated on the inner surface of a glove designed to assist with easier donning.

Powder-Free: Gloves that have undergone a process of chlorination or that have been polymer coated to eliminate the residue from the inner surface of a glove.

Polymer Coating: A coating of a special polymer resin applied to the inside and outside of the glove to seal the surface and provide a lubricant for donning the glove.

Tensile: The force measured over a cross-sectional area of a given material under strain. The value is usually measured at the instant the material fails and is reported in megapascals (MPa).

Textured: The raised or uneven surface of a glove that helps to prevent slippage especially when handling wet objects. Texturing can be found in the fingertips or the complete glove.

Disposable Glove Types

Natural Rubber Latex (NRL)

Natural Rubber Latex is a highly durable and flexible material that provides a high measure of barrier protection against pathogens and environmental contaminants. Natural rubber latex provides good resistance to numerous acids and ketones. It is the most elastic of the disposable glove materials and is inexpensive. Products containing natural rubber latex may cause allergic reactions in some individuals.

Those using latex gloves who develop a rash, should stop using these gloves immediately. If you suspect that you may have an allergy related to the agents used to manufacture natural rubber latex gloves, consider powder-free or alternative synthetic glove materials such as nitrile, neoprene or vinyl.

Neoprene

A synthetic material extracted from petroleum, neoprene provides good resistance to acids, bases and oils but provides less resistance to abrasion and cuts than latex or nitrile materials. Neoprene is closest in fit and comfort to latex as a synthetic alternative for users who may be sensitive to latex.

Nitrile

Nitrile is a synthetic material, extracted from petroleum. It is resistant to bases, oils, greases and hydrocarbons, and provides an effective barrier from blood-borne pathogens. Nitrile gloves offer improved abrasion, cut and puncture resistance versus latex. Synthetic nitrile gloves provide a low cost alternative to latex for users who may be sensitive to latex.

Vinyl

Vinyl is a synthetic plastic material manufactured of Polyvinyl Chloride (PVC). It has good resistance to acids and bases. They provide a lower level of resistance to mechanical hazards such as abrasion, cuts, and punctures because vinyl is not as elastic or strong as other materials. Vinyl gloves are the least expensive option for gloves and are commonly used in applications for food service, food processing, light duty maintenance and clean-up, and laboratory testing (especially where resistance to acids is required).

Leather Glove Information

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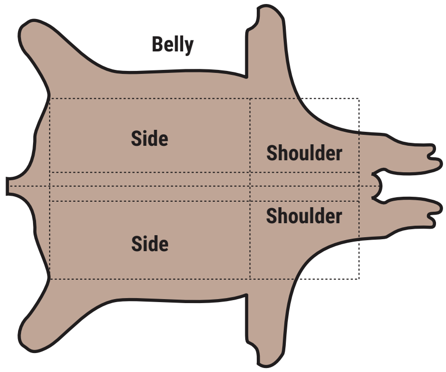
Leather Gloves

Cuts of Leather

Grain: Grain leather is the smooth exterior side of the hide. It provides durability and dexterity.

Split: Split leather is the rougher interior side of the hide.
The different types of split are side, shoulder or belly split.

- **Side Split:** Side split comes from the rib area of the animal. This part of the leather is the most durable and provides the greatest protection because of its greater density of fibers.
- **Shoulder Split:** Shoulder split is more economical than side split, but less durable. The additional movement of the animal in this shoulder area creates less fibers and a more visible texture difference.
- **Belly Split:** Belly split leather is the most economical; however it has the least consistency of texture and appearance.



Leather Types

Cow: Cowhide is the most commonly used leather due to its abundance. Advantages include comfort, durability, excellent abrasion resistance and breathability.

Pig: Pigskin affords the greatest breathability due to its porous texture. Additionally, pigskin tends to become softer with use and withstands moisture without stiffening. When laundered, this leather will return more to its natural soft texture than other leathers.

Goat: Grain goatskin is twice as durable as cow grain and pig grain leather. The natural lanolin produced by goats helps to create the softest, most abrasion-resistant leather. Highly recommended for applications requiring tactile sensitivity.

Deer: Known to be one of nature's most luxurious, softest leathers, providing all day comfort and sensitivity to touch.

Performance	Grain Pigskin	Grain Cowhide	Split Cowhide	Grain Deerskin	Grain Goatskin
Abrasion Resistance	Best	High	High	Fair	High
Puncture Resistance	High	Best	Best	Fair	High
Tensile Strength	Good	High	High	Best	High
Breathability	Best	Fair	Fair	Fair	Fair
Flexibility	High	Good	Fair	High	High
Tactile Sensitivity	High	Good	Fair	High	High
Insulation Ability	Low	Good	Good	Best	Low
Moisture Resistance	Best	Fair	Fair	Better	Good
Relative Cost	Low	Mid-Range	Low	High	Mid-Range

Cuff Materials

Leather: For longer wear and heavy-duty applications (launderable).

Denim: Economical single-fabric material (launderable).

Duck: Single ply of cotton material (launderable).

Plasticized: Waterproof polyethylene layer laminated between two pieces of fabric (launderable).

Rubberized: Two layers of fabric with a rubber material in between. Adds water resistance in addition to heavier wear resistance.

Starched: Two layers of fabric laminated, then starched (launderable).

Glove Construction

Gunn Cut

Features: Seamless on back. The palm side of the middle two fingers is a separate glove pattern and is sewn to the palm at the base of the middle two fingers. In full leather and leather palm styles, the seam is reinforced with a welt that gives additional resistance to wear in this critical area.

Benefits: Seam in natural hand crease allows flexibility; seamless back increases comfort. Finger seams away from the palm increase gloves' durability and wear life.

Clute Cut

Features: Seamless palm made from a continuous piece of leather. Back of glove has parallel seams. Finger side seams are toward palm side of glove.

Benefits: Seamless palm means greater ease of movement and comfortable gripping. Primarily used in fabric gloves and lightweight leathers.

Thumb Styles

Straight Thumb: Designed for close-fisted work. The seams are out of the wear area during gripping activities.

Keystone Thumb: Allows the greatest freedom of movement and is the most comfortable.

Wing Thumb: Designed for open-handed work such as pushing, pulling and lifting.